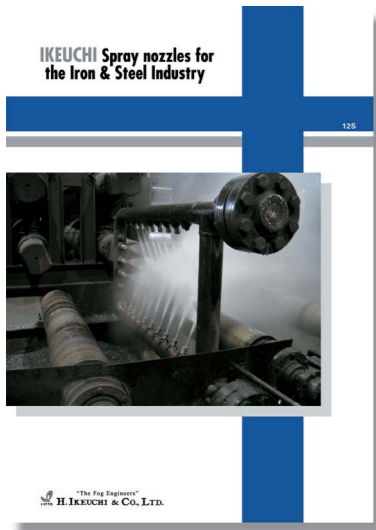


## Related Catalog



### Spray nozzles for the Iron & Steel Industry

Introduces a wide line-up of nozzles that meets every need in steel-making industry: cooling, cleaning, clog prevention, etc.



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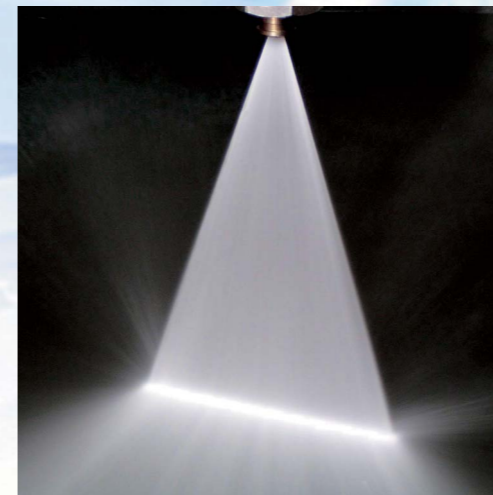
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World's highest performance

# DESCALING NOZZLES

Patented



## TDSS series

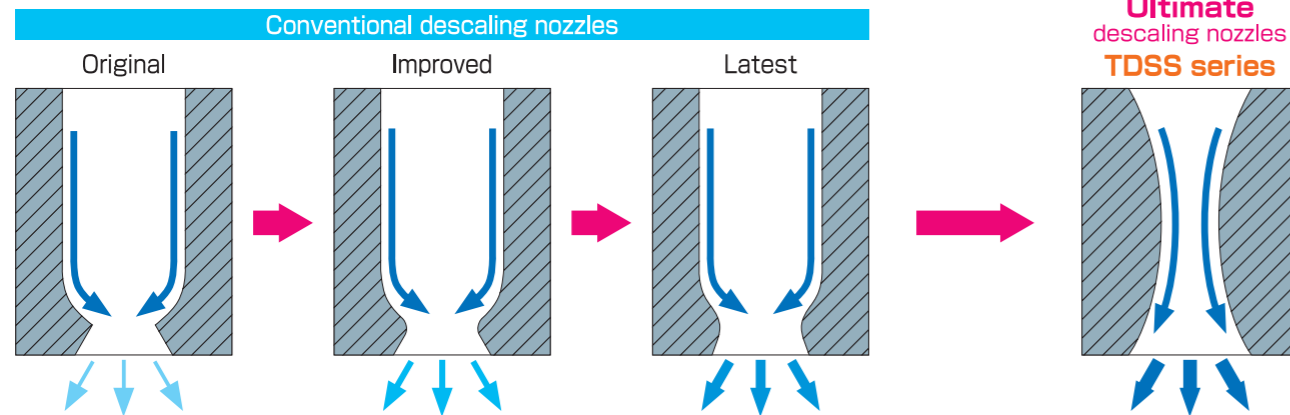


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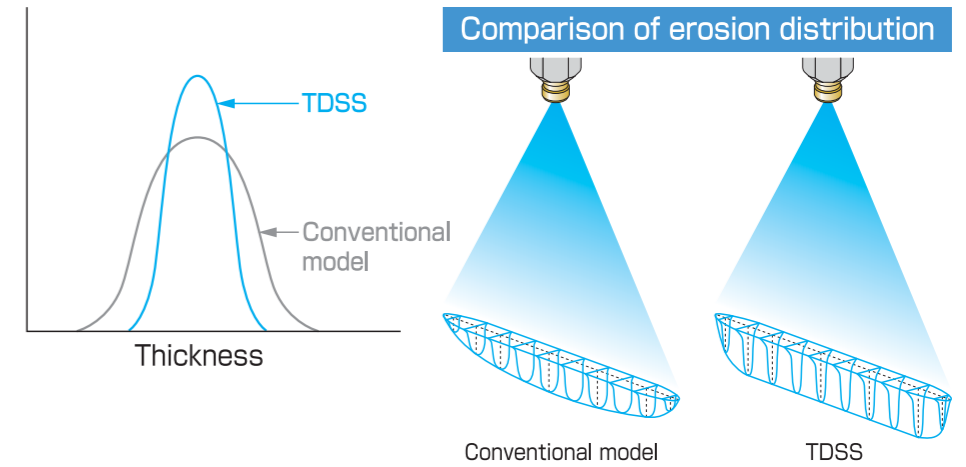
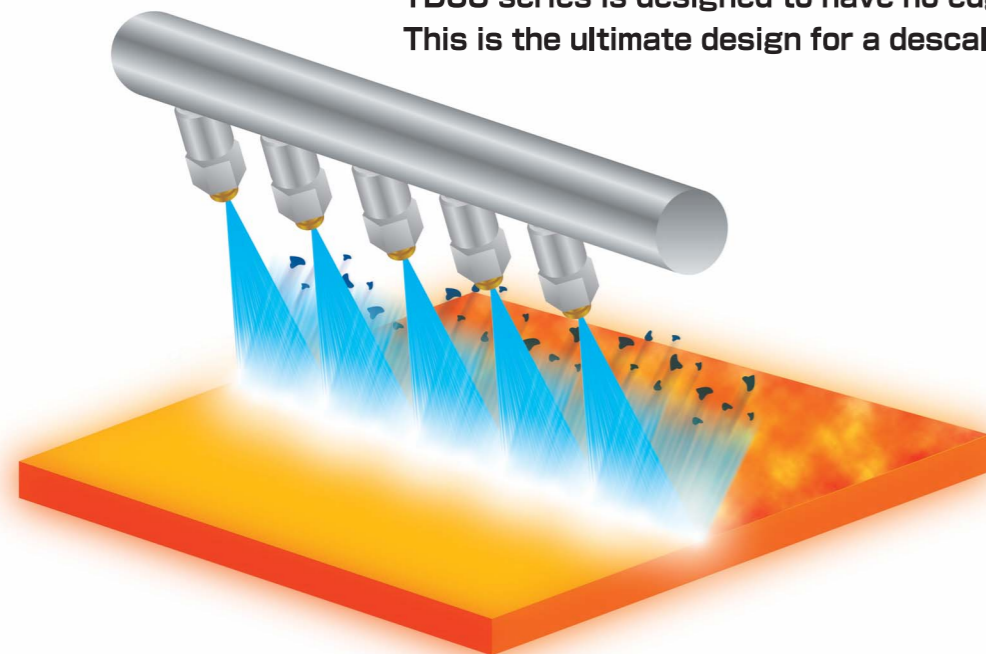
# Ultimate Descaling Nozzle for Steel Making Industry

TDSS series DESCALING NOZZLES

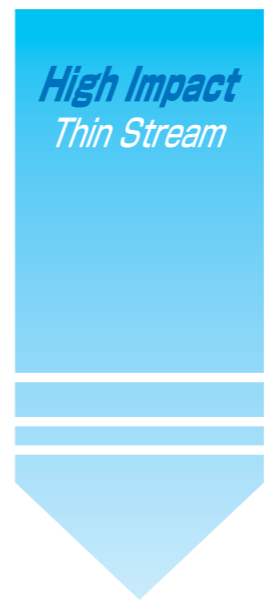
## Comparison of nozzle tip



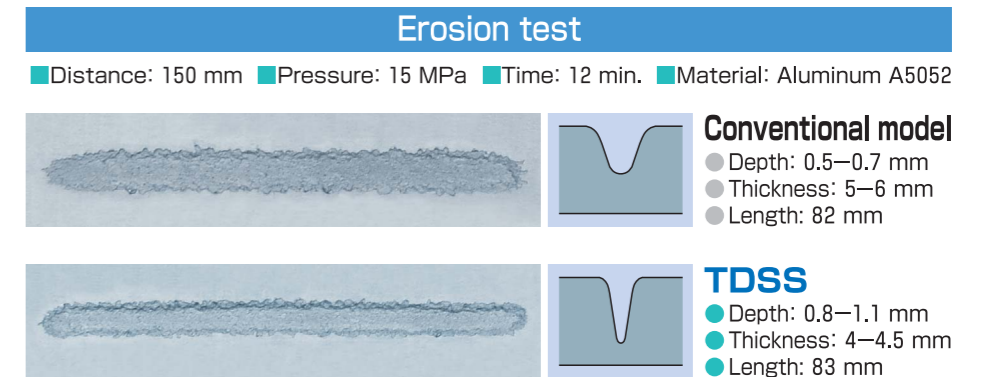
TDSS series is designed to have no edges inside the orifice. This is the ultimate design for a descaling nozzle.



TDSS's **razor-like thin stream** has 20% higher impact compared to the conventional nozzles. TDSS is designed to have uniform spray impact on the cross direction.



High impact thin stream → Improves productivity and quality



TDSS, with **much higher spray impact**, increases erosion depth by 20% compared to the conventional model. Minimal traces of scales improve productivity.



Even with **10-20% less water**, TDSS provides the same spray impact as the conventional model.

	Conventional model	TDSS
Erosion depth	1.3 mm	1.3 mm
Spray capacity	134 ℓ/min	110 ℓ/min

Water Saving Effect

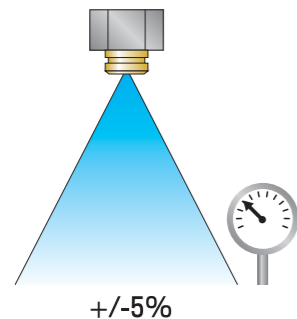
Example) 2 hours operation a day, a TDSS series nozzle achieves

↓

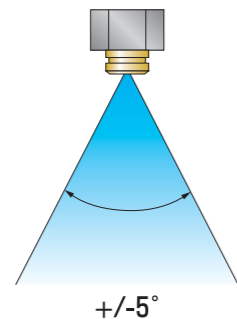
Daily water savings of **3 tons** per day or **1,100 tons** per year.

## Guarantee of Spray Nozzle Performance

### Spray capacity tolerance



### Spray angle tolerance



All IKEUCHI's precision-made hydraulic spray nozzles are guaranteed for spray capacities and spray angles as shown, based on tests under the most accepted pressure conditions applied in actual applications. This guarantee covers metal, plastic, and ceramic nozzles.

The TDSS series has the most-precise characteristics among all high-precision machine-made hydraulic nozzles.

They are guaranteed through strict quality control, with spray testing at 15 MPa and a 100% inspection rate.

Each nozzle is individually numbered and tested, with its spray capacity, spray angle, and spray impact distribution date logged at our testing facility.

These date logs are always available upon request.

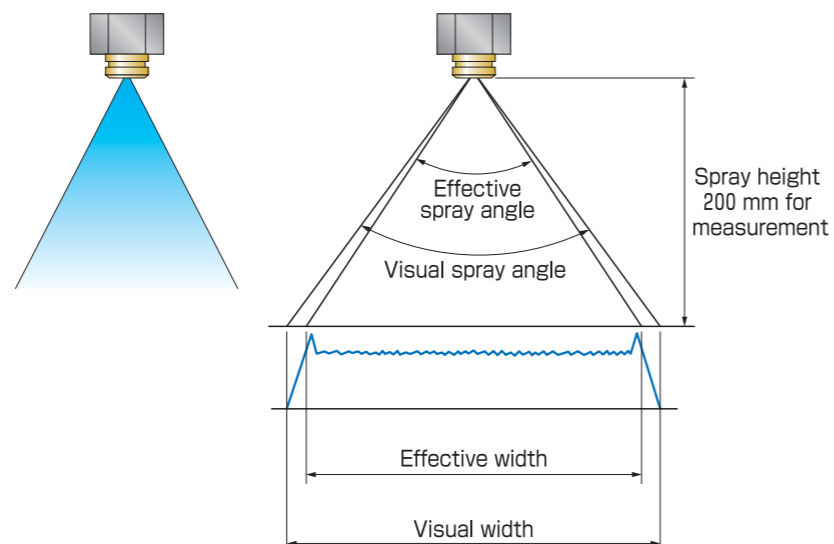
We guarantee the following at 200 mm spray height and 15 MPa pressure:

- Spray capacity tolerance +/-3% or less
- Spray angle tolerance +/-2° or less

For use where higher precision is required, such as for finishing mills, please consult with us.

### ● Spray angle of TDSS series

IKEUCHI specifies TDSS-series nozzle's effective spray angle as being calculated from the effective width of spray impact distribution based on the spray height of 200 mm.



## DESCALING NOZZLES TDSS series

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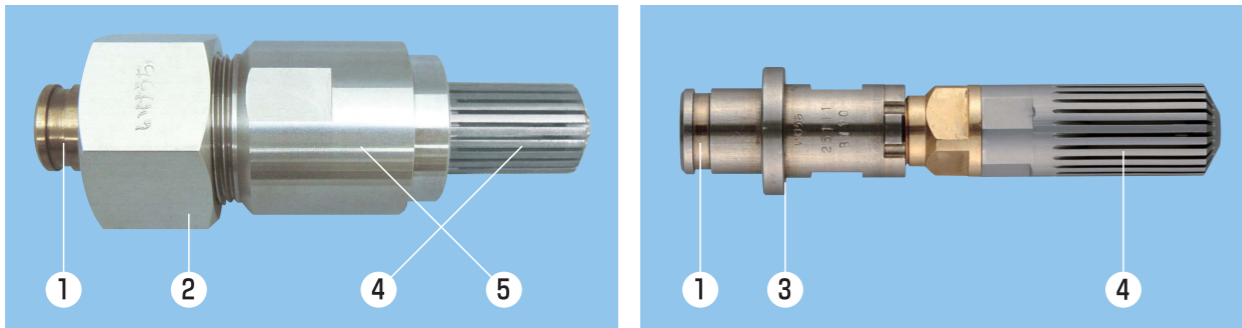
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# TDSS Nozzles Lineup

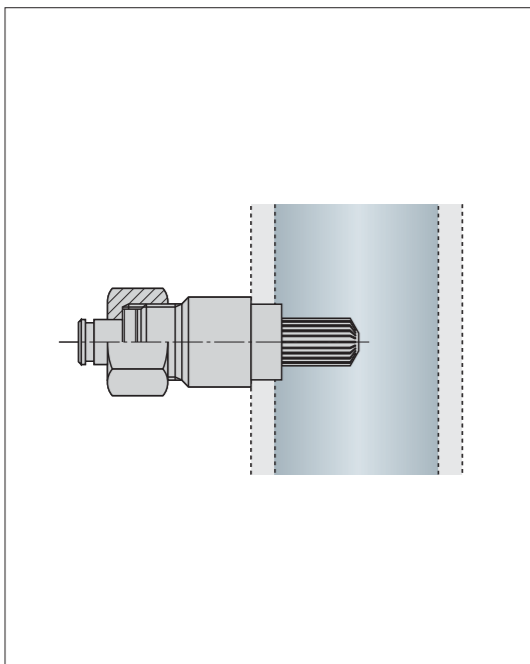
DESCALING NOZZLES TDSS series

## Standard type

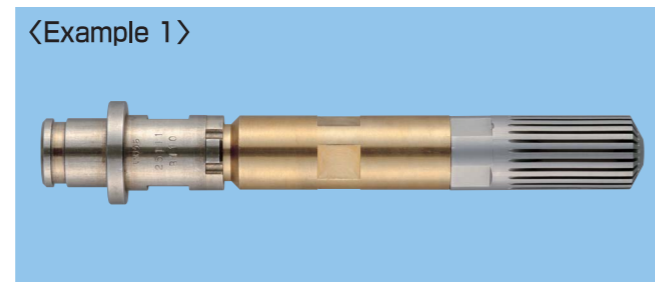


1 Nozzle tip	2 Cap	3 Packing	4 Stabilizing strainer	5 Adaptor
Standard nozzle tip	Standard cap		Standard strainer (type B)	Welding adaptor
Nozzle tip with cover	Protective cap		Long strainer (type E)	Threaded adaptor
Long nose nozzle tip			Strainer with check valve (type LCV) Material is Brass (except for strainer with free passage diameter $\phi$ 1).	

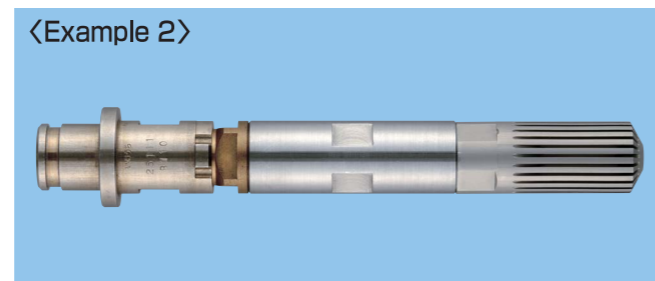
## Example installation



## Examples of nozzle assembly



● Standard nozzle tip + Packing + Long strainer



● Standard nozzle tip + Packing + Strainer with check valve

Spray Angle Code	Spray Capacity Code	Spray Angle (°)			Spray Capacity								Free Passage Diameter (mm)
		10 MPa (1450 psi)	15 MPa (2175 psi)	20 MPa (2900 psi)	7 MPa (1015 psi)		10 MPa (1450 psi)		15 MPa (2175 psi)		20 MPa (2900 psi)		
		ℓ/min	US Gal./min	ℓ/min	US Gal./min	US Gal./min	ℓ/min	US Gal./min	ℓ/min	US Gal./min	ℓ/min	US Gal./min	
65	037	65°	65°	65°	25.3	6.68	30.2	7.97	37.0	9.77	42.7	11.28	0.7
	056	65°	65°	65°	38.3	10.11	45.7	12.07	56.0	14.79	64.7	17.09	0.7
45	015	45°	45°	45°	10.2	2.69	12.2	3.22	15.0	3.96	17.3	4.57	0.6
44	074	44°	44°	44°	50.6	13.36	60.4	15.95	74.0	19.55	85.4	22.56	1.0
	089	44°	44°	44°	60.8	16.06	72.7	19.20	89.0	23.51	103	27.21	1.0
40	027	40°	40°	40°	18.9	4.99	22.6	5.97	27.7	7.31	32.0	8.45	0.7
	056	40°	40°	40°	38.3	10.11	45.7	12.07	56.0	14.79	64.7	17.09	1.0
	083	40°	40°	40°	56.6	14.98	67.6	17.88	82.8	21.87	95.6	25.28	1.0
	111	40°	40°	40°	75.8	20.00	90.6	23.91	111	29.32	128	33.81	1.0
38	037	38°	38°	38°	25.3	6.68	30.2	7.97	37.0	9.77	42.7	11.28	0.7
35	083	35°	35°	35°	56.6	14.98	67.6	17.88	82.8	21.87	95.6	25.28	1.0
	111	35°	35°	35°	75.8	20.00	90.6	23.91	111	29.32	128	33.81	1.0
	138	35°	35°	35°	94.3	24.96	113	29.85	138	36.45	159	42.27	1.5
32	027	32°	32°	32°	18.9	4.99	22.6	5.97	27.7	7.31	32.0	8.45	0.7
	044	32°	32°	32°	30.1	7.95	35.9	9.48	44.0	11.62	50.8	13.42	1.0
	056	32°	32°	32°	38.3	10.11	45.7	12.07	56.0	14.79	64.7	17.09	1.0
	065	32°	32°	32°	44.4	11.73	53.1	14.02	65.0	17.17	75.1	19.84	1.0
	083	32°	32°	32°	56.6	14.98	67.6	17.88	82.8	21.87	95.6	25.28	1.0
28	111	32°	32°	32°	75.8	20.00	90.6	23.91	111	29.32	128	33.81	1.0
	016	28°	28°	28°	11.3	2.98	13.5	3.56	16.5	4.35	19.1	5.04	0.6
	022	28°	28°	28°	15.0	3.96	18.0	4.75	22.0	5.81	25.4	6.71	0.6
	056	28°	28°	28°	38.3	10.11	45.7	12.07	56.0	14.79	64.7	17.09	1.0
	083	28°	28°	28°	56.6	14.98	67.6	17.88	82.8	21.87	95.6	25.28	1.0
25	111	28°	28°	28°	75.8	20.00	90.6	23.91	111	29.32	128	33.81	1.0
	138	25°	25°	25°	94.3	24.96	113	29.85	138	36.45	159	42.27	1.5
	056	25°	25°	25°	38.3	10.11	45.7	12.07	56.0	14.79	64.7	17.09	1.0
	083	25°	25°	25°	56.6	14.98	67.6	17.88	82.8	21.87	95.6	25.28	1.0
20	111	25°	25°	25°	75.8	20.00	90.6	23.91	111	29.32	128	33.81	1.0
	083	20°	20°	20°	56.6	14.98	67.6	17.88	82.8	21.87	95.6	25.28	1.0
	111	20°	20°	20°	75.8	20.00	90.6	23.91	111	29.32	128	33.81	1.5

## Structure

Offset direction  
Left (L) Right (R)

1 Nozzle tip (a)Tip (b)Tip body

3 Packing

4 Stabilizing strainer (c)Strainer adaptor (d)Stabilizer (e)Strainer

Series	Types of Strainers	Outer dimensions (mm)			
		L1	L2	a	$\phi d$
TDSS	Standard strainer (type B)	126	52	25.5	30
	Long strainer (type E)	173	52	25.5	30
	Strainer with check valve (type LCV)	180	52	25.5	30

**Materials**

1 Nozzle tip

- Standard nozzle tip/Tip with cover
  - Tip: Tungsten carbide
  - Tip body: S303
- Long nose nozzle tip
  - Tip: Tungsten carbide
  - Tip body: S304

3 Packing: Copper

4 Stabilizing strainer

- Standard/Long strainer
  - Strainer adaptor: Brass (C3604)
  - Strainer: Brass (S316L for strainer with free passage diameter  $\phi$ 1 only)
  - Stabilizer: S316L
- Strainer with check valve
  - Strainer adaptor: Brass (C3604)
  - Check valve adaptor: S403
  - Piston valve: S303
  - Spring: S304
  - Strainer: Brass (S316L for strainer with free passage diameter  $\phi$ 1 only)
  - Stabilizer: S316L

In our material code, "S" represents "stainless steel". (Example) S303 represents stainless steel 303.

**How to order** Please inquire or order for a specific nozzle using this coding system.

\* The model number is a nozzle assembly description; comprised of nozzle tip, packing, and stabilizing strainer.

<Example> ... $\frac{3}{8}$ TDSS32083KV-LCV (15°R)

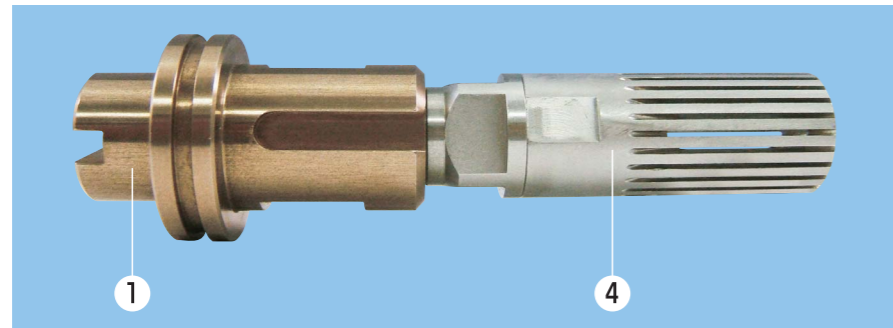
$\frac{3}{8}$  TDSS 32 083 KV - LCV (15°R)

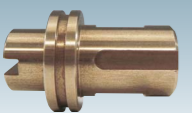
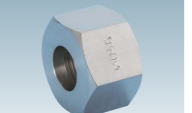



Spray angle code	Spray capacity code	Type of nozzle tip	Type of stabilizing strainer	Tip offset angle
-	-	- (Standard) KV (With cover) LN (Long nose)	B (Standard) E (Long type) LCV (With check valve)	R (Right) L (Left)

\*Please order caps and adaptors separately. Cap material: S303  
Optional: S420J2 (selective hardened)      Welding Adaptor: S403  
Threaded adaptor: S303

# TDSS Nozzles Lineup

## High-pressure type

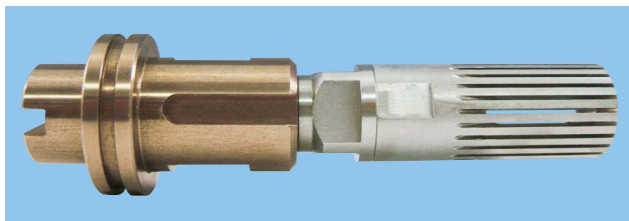


<b>1</b> Nozzle tip	<b>2</b> Cap	<b>3</b> Packing	<b>4</b> Stabilizing strainer	<b>5</b> Adaptor
 High-pressure tip	 High-pressure cap		 High-pressure stabilizing strainer (type U) <small>(*Design and dimensions are subject to change.)</small>	 Welding adaptor

Spray Angle Code	Spray Capacity Code	Spray Angle (°)			Spray Capacity								Free Passage Diameter (mm)	
		10 MPa (1450 psi)	15 MPa (2175 psi)	25 MPa (3625 psi)	10 MPa (1450 psi)		15 MPa (2175 psi)		25 MPa (3625 psi)		50 MPa (7251 psi)			
		l/min	US Gal./min	l/min	US Gal./min	l/min	US Gal./min	l/min	US Gal./min	l/min	US Gal./min	l/min	US Gal./min	
45	015U	45°	45°	45°	12.2	3.22	15.0	3.96	19.4	5.12	27.4	7.23	0.6	
38	037U	38°	38°	38°	30.2	7.97	37.0	9.77	47.8	12.62	67.6	17.86	0.7	

\*If you require specifications other than those given above, please fill in the "check sheet" on page 25 and consult us.

### Example of nozzle assembly



#### Materials

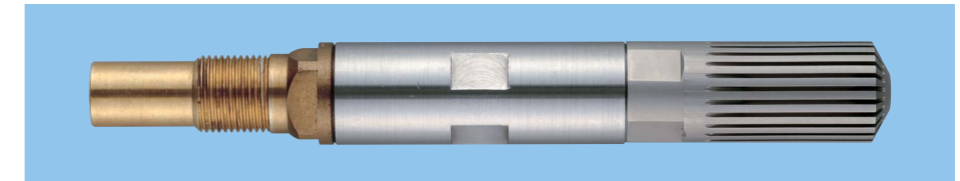
- Tip: Tungsten carbide
- Tip body: S303
- Packing: Copper
- Strainer adaptor: S303
- Strainer: S316L
- Stabilizer: S316L

In our material code, "S" represents "stainless steel".  
(Example) S303 represents stainless steel 303.

# Options & Accessories

## Check valve

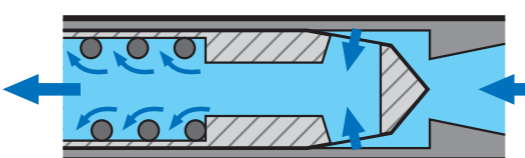
Springs are set outside of the flow passage, which results in high flow straightening effect and proper check valve function.



The operating pressure of check valve is 1 MPa.

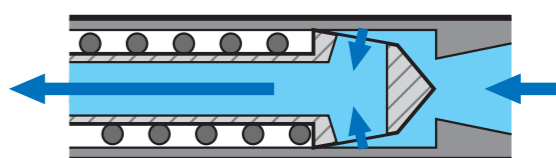
Effect	Features
<ul style="list-style-type: none"> <li>● Prevents excess cooling of plate due to dripping.</li> <li>● Prevents damage to nozzle due to water hammer.</li> <li>● Water savings.</li> <li>● Improves productivity due to shortening of cycle time.</li> </ul>	<ul style="list-style-type: none"> <li>● Spring is installed outside of flow passage to prevent clogging that interferes with check valve function.</li> <li>● High flow-straightening effect due to minimal pressure loss of inner structure.</li> <li>● Long life due to special spring design.</li> </ul>

#### Conventional check valve



- Springs are in the flow passage.
- ↓
- Particles clog between the springs.
- ↓
- Check valve is unable to work properly.

#### TDSS check valve



- Springs are set outside of the flow passage.
- ↓
- Particles never clog the springs.
- ↓
- Check valve keeps working properly.

### TDSS with check valve spraying



#### How to order

Please inquire or order for a specific nozzle using this coding system.

\*The model number is a nozzle assembly description; comprised of nozzle tip, packing, and stabilizing strainer.

<Example>...3/8TDSS38037U-U (15°R)

3/8 TDSS 38 037U - U (15°R)

Spray angle code    Spray capacity code

Type of stabilizing strainer

Tip offset angle

■ R (Right)  
■ L (Left)

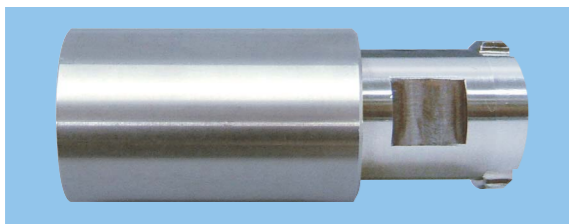
\*Please order caps and adaptors separately. ( Cap material: S303    Optional: S420J2 (selective hardened)    Welding Adaptor: S403 )

## ● Long nose nozzle tip

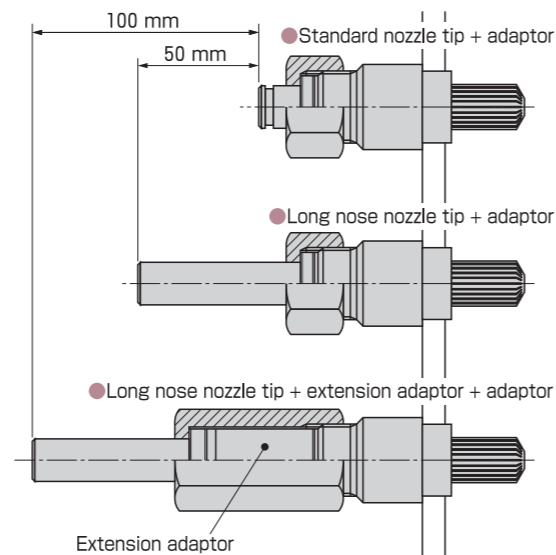
By changing only the nozzle tip to a long nose tip (on an existing header), you can shorten spray distance by up to 50 mm and increase spray impact. Please refer to page 14 for the relations between spray distance and spray impact.



## ● Extension adaptor

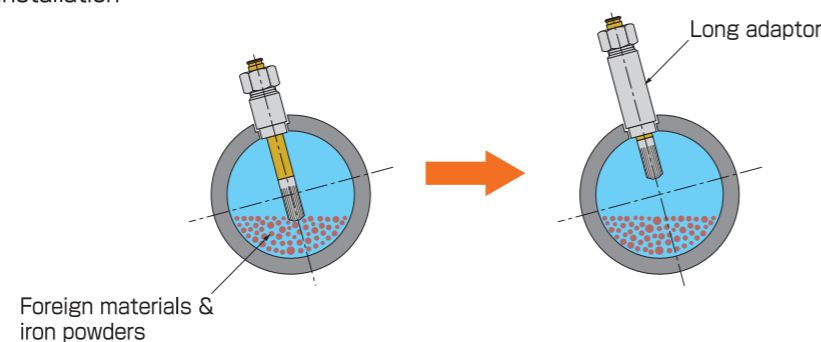
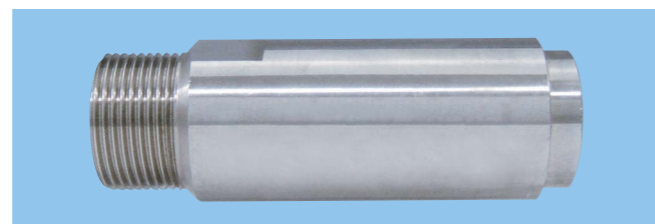


Extension adaptor can shorten spray distance to increase spray impact (descaling effect) without changing the nozzle tip. Further extension is possible with a combination of an extension adaptor and a long nose nozzle tip.

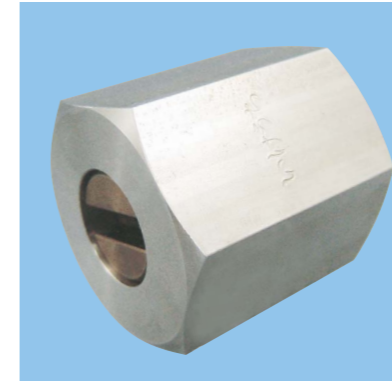


## ● Long adaptor

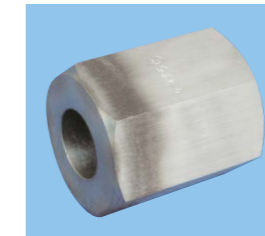
Foreign materials and iron powders settled at the bottom of a header can cause clogging by flowing into a strainer. This long adaptor prevents strainer clogging by setting the strainer itself away from those foreign materials and iron powders deposited at the bottom of a header. Please refer to page 20 for details of installation position of strainer.



## ● Protective cap



Protective cap covers whole nozzle tip and protects the nozzle and adaptor from external damage caused by rebounded scale and splashed water.



● Option  
Protection cap made of selective hardened stainless steel

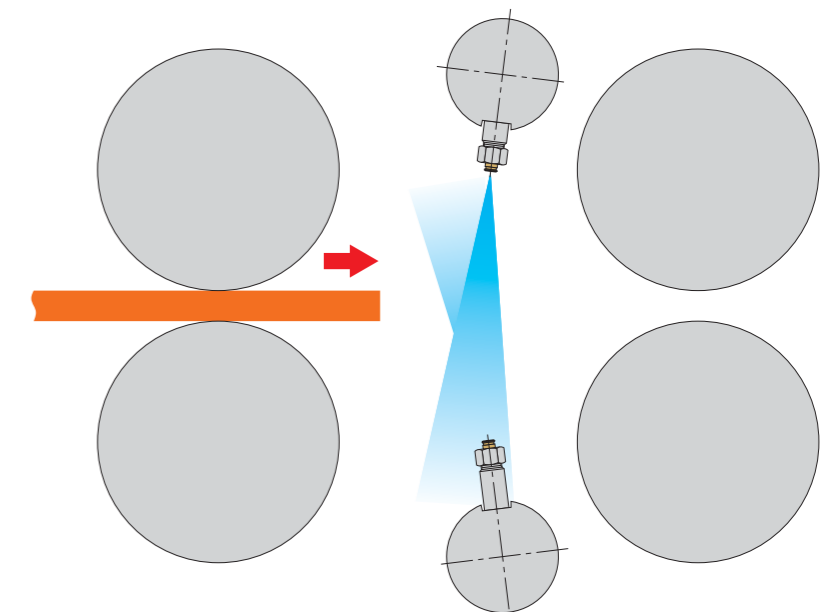
## ● Nozzle tip with cover

Nozzle tip with cover protects nozzle tip from wearing out by rebounded scale and splashed water.



## Nozzle tips worn from being sprayed by opposing nozzles

Photos below are actual examples of a nozzle tip worn from being sprayed by an opposing nozzle when used without a protective cap. Protective cap and nozzle tip with cover are recommended in cases where nozzles are exposed to spray from opposing nozzles.

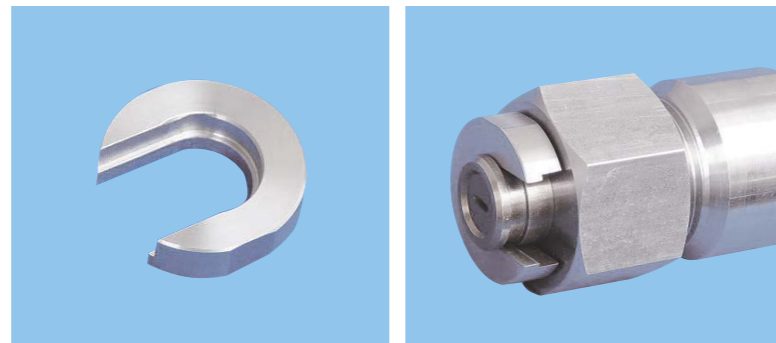


# Option & Accessories

## Disassembly jigs for TDSS

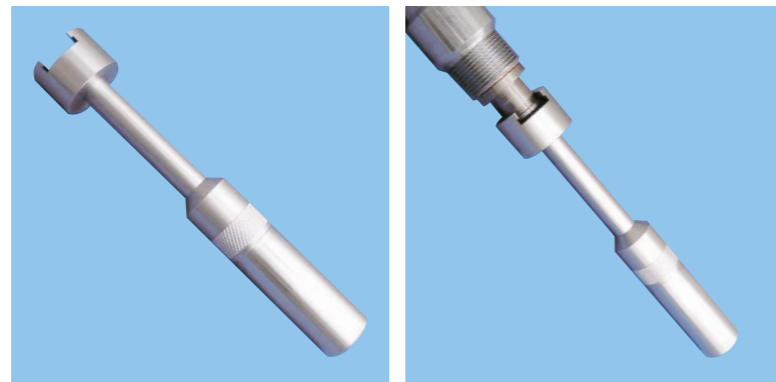
### C shaped nozzle disassembly jig

Before loosening the cap, put this jig in the groove of the nozzle tip. The nozzle tip can then be loosened by twisting the cap and can be taken off easily.



### Pull out type nozzle disassembly jig

After disassembling the cap, hook this jig on the groove of the nozzle tip and pull out the nozzle from the adaptor.



### Screw type nozzle disassembly jig

After disassembling the cap, put this jig in the groove of nozzle tip and turn the jig handle to pull out the nozzle tip.

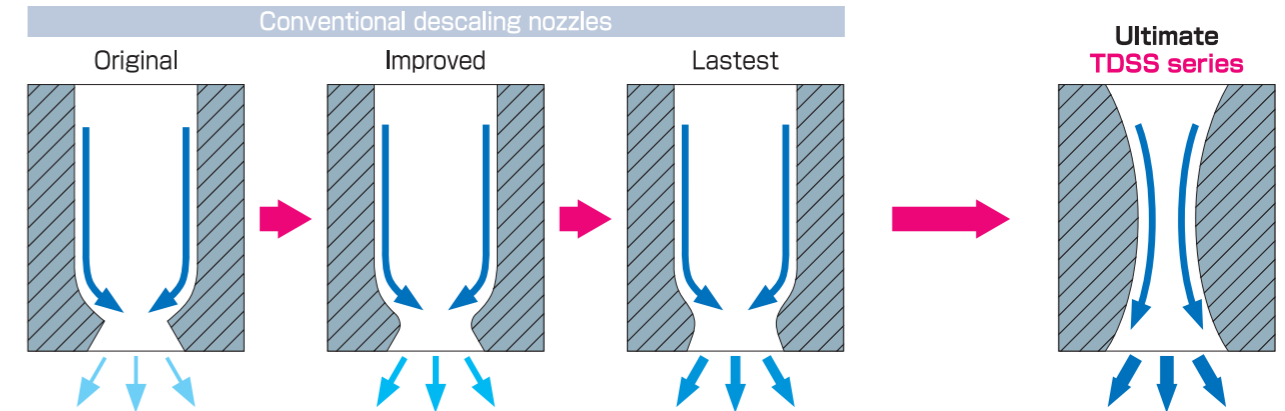


# Features of TDSS

## Nozzle tip

When making flat spray pattern with conventional nozzles, it is necessary to collide water streams inside the nozzles as shown in the figure below. This collision is caused by the existence of the edge at the orifice. However, the edge reduces the speed and the impact of the water. The performance of the nozzle becomes worse as the water stream wears it out.

Eliminating this weakness, IKEUCHI's TDSS series is designed to have no edge at the orifice (thus no water collision), which maximizes the speed and spray impact of the water flow. The tip has a longer lifespan even under high-pressure spraying. These features make TDSS the ultimate descaling nozzle.



	Conventional model	TDSS
Photo of nozzle orifice		
2D spray impact		
3D spray impact		

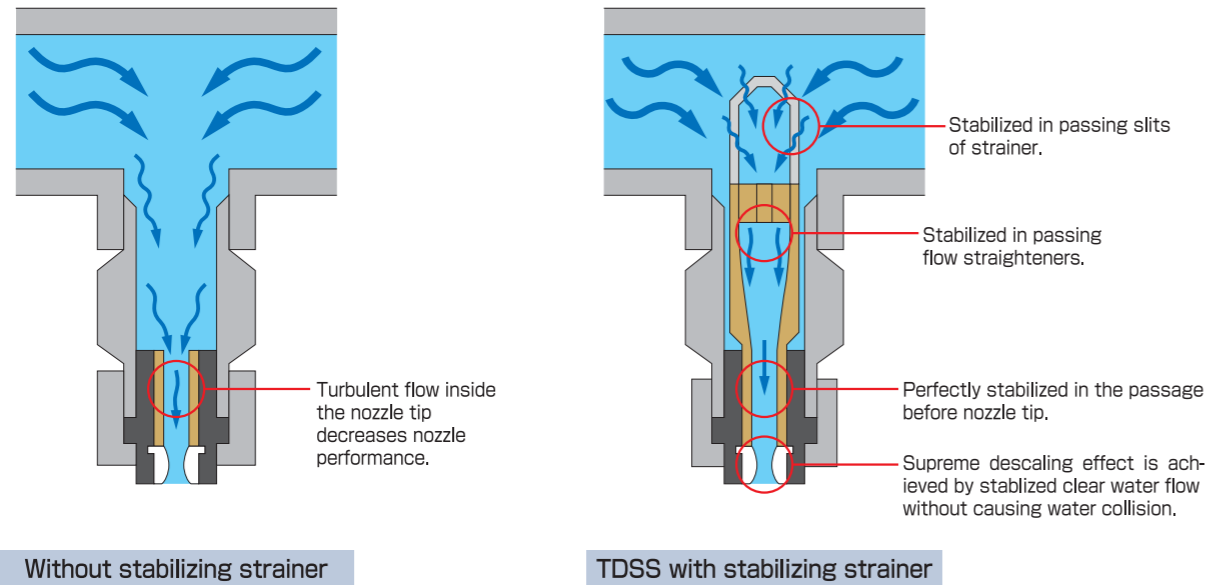
## Erosion test

■ Spray distance: 150 mm ■ Spray pressure: 15 MPa ■ Erosion time: 12 min. ■ Plate material: Aluminum A5052

		<b>Conventional model</b> <ul style="list-style-type: none"> <li>● Erosion depth: 0.5 to 0.7 mm</li> <li>● Erosion thickness: 5 to 6 mm</li> <li>● Erosion length: 82 mm</li> </ul>
		<b>TDSS</b> <ul style="list-style-type: none"> <li>● Erosion depth: 0.8 to 1.1 mm</li> <li>● Erosion thickness: 4 to 4.5 mm</li> <li>● Erosion length: 83 mm</li> </ul>

## Stabilizing strainer

As highly-turbulent flow in the descaling spray header makes spray performance drop remarkably, it is necessary to straighten the water flow. IKEUCHI's stabilizer is designed to maximize the flow straightening effect.

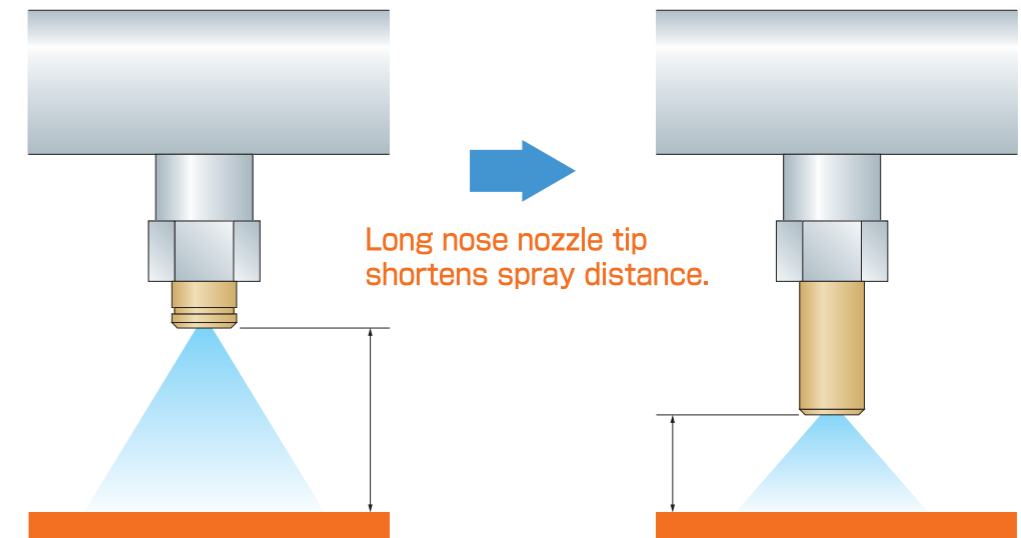


Without stabilizing strainer

TDSS with stabilizing strainer

## Spray distance

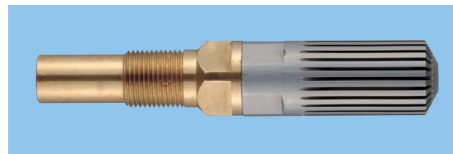
Spray impact is improved by shortening spray distance when spray capacity and spray width are fixed. Long nose nozzle tip and extending adaptor are available to increase spray impact without changing pipes.



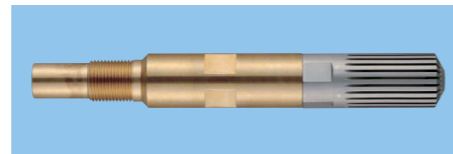
## Spray impact increased by longer stabilizer

Spray pressure: 15 MPa   Spray distance: 150 mm   Erosion time: 15 seconds

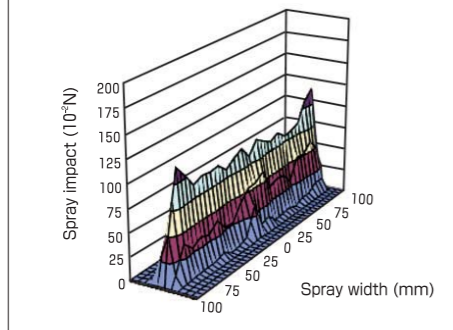
Standard stabilizing strainer (type B)



Long type stabilizing strainer (type E)



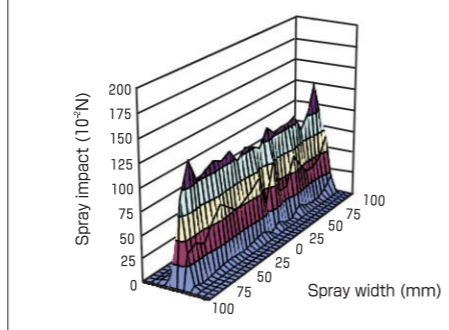
3D spray impact



Erosion of lead plate



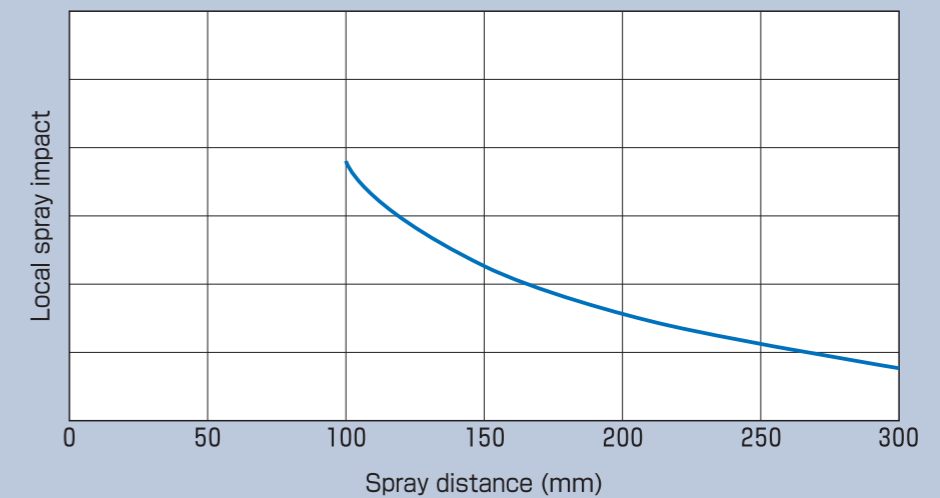
3D spray impact



Erosion of lead plate



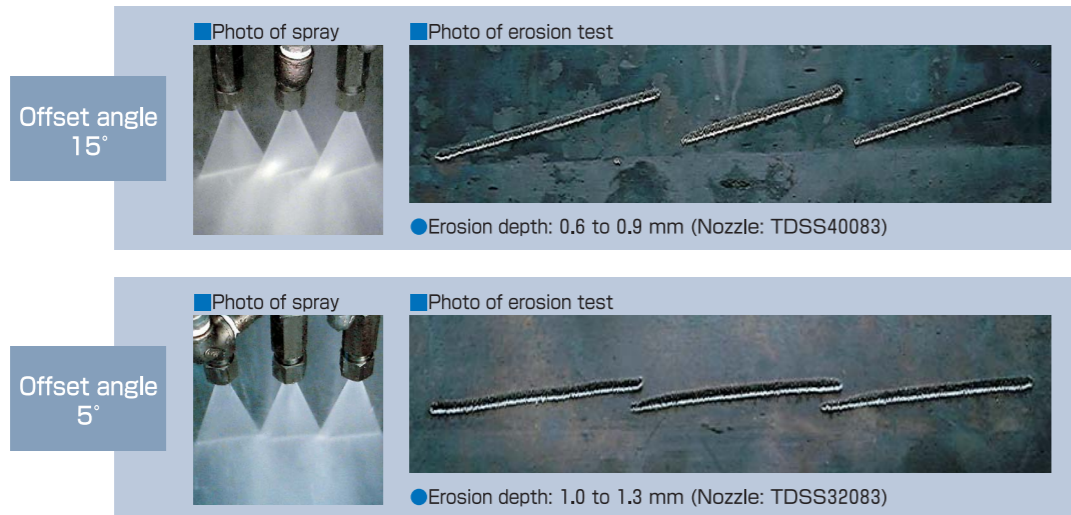
Relations between spray distance and local spray impact on fixed spray capacity and spray width





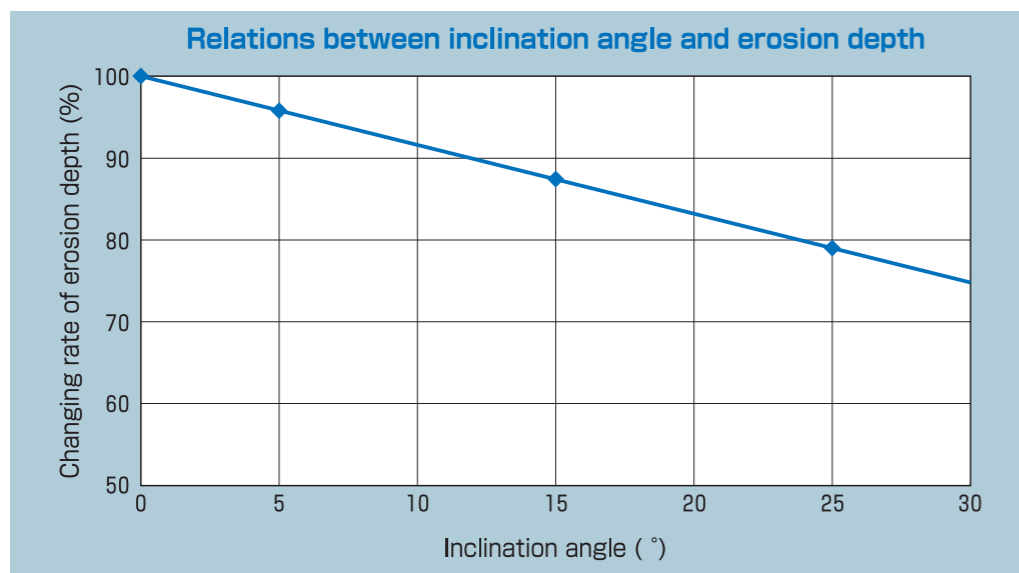
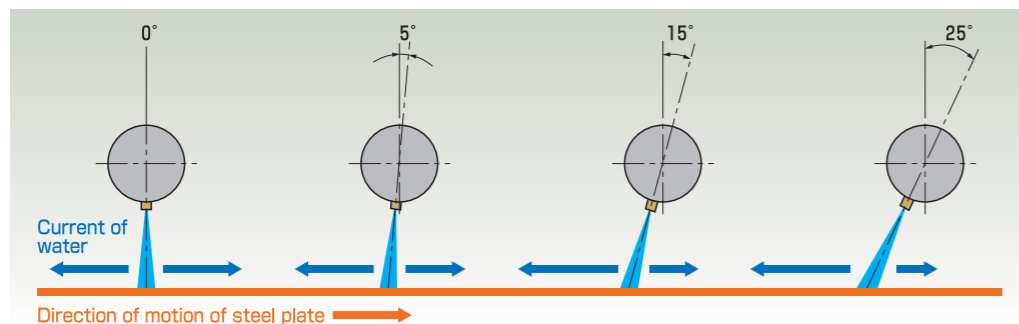
## Offset angle

Water sprayed from nozzle arrays often has interference where sprays overlap, which weakens spray impact force at the edges of the spray width. You can prevent the resultant scale remnants by providing a suitable offset angle (5-10 degrees).



## Inclination angle

By changing inclination angle, descaling effect and scale discharging effect are also changed.

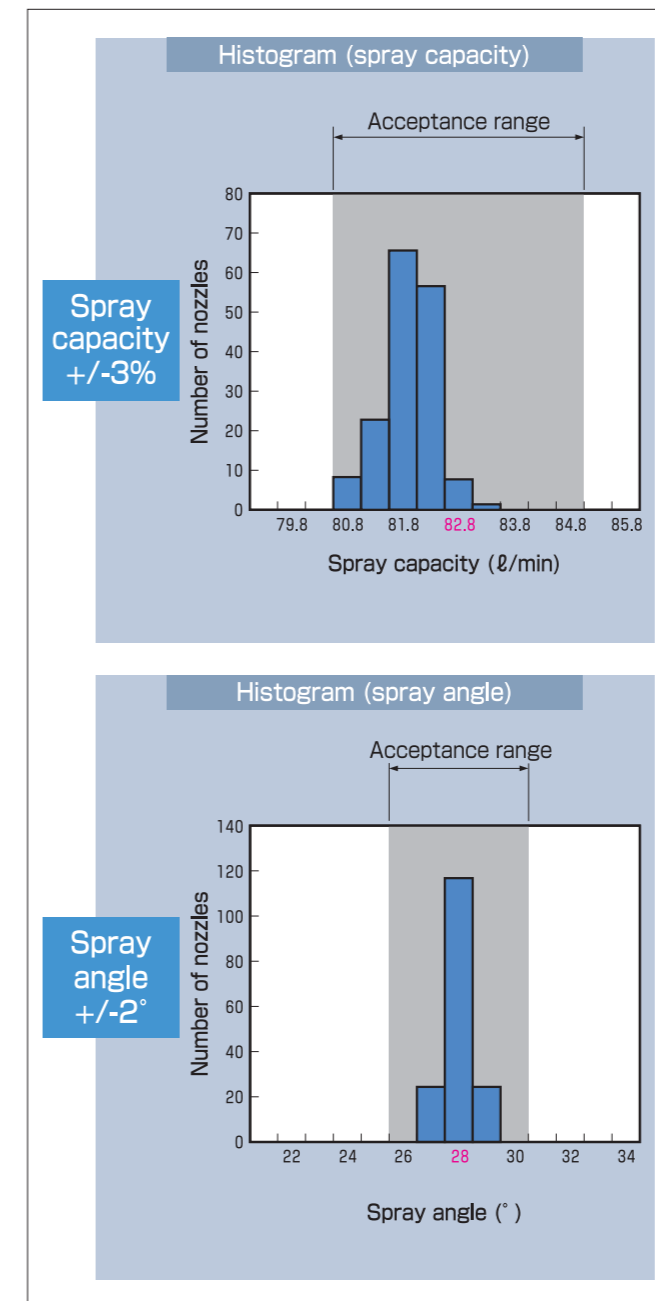


## Quality control and acceptance criteria

The histograms below show lot-to-lot performance variation of the TDSS series. TDSS series with minimal performance variation make a great contribution to stable descaling. Since all TDSS nozzles are guaranteed in spray performance, you don't have to worry about changes in performance when replacing nozzles; every replaced nozzle has the same high quality.

### 3/8 TDSS28083-E (15°R)

#### Variation in spray capacity and spray angle (and acceptance criteria)



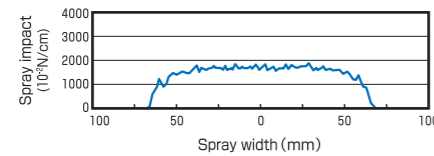
#### Acceptance criteria of spray impact distribution

Grade	Spray impact distribution	Criteria
A1		Accept
A2		
B		
C		Reject

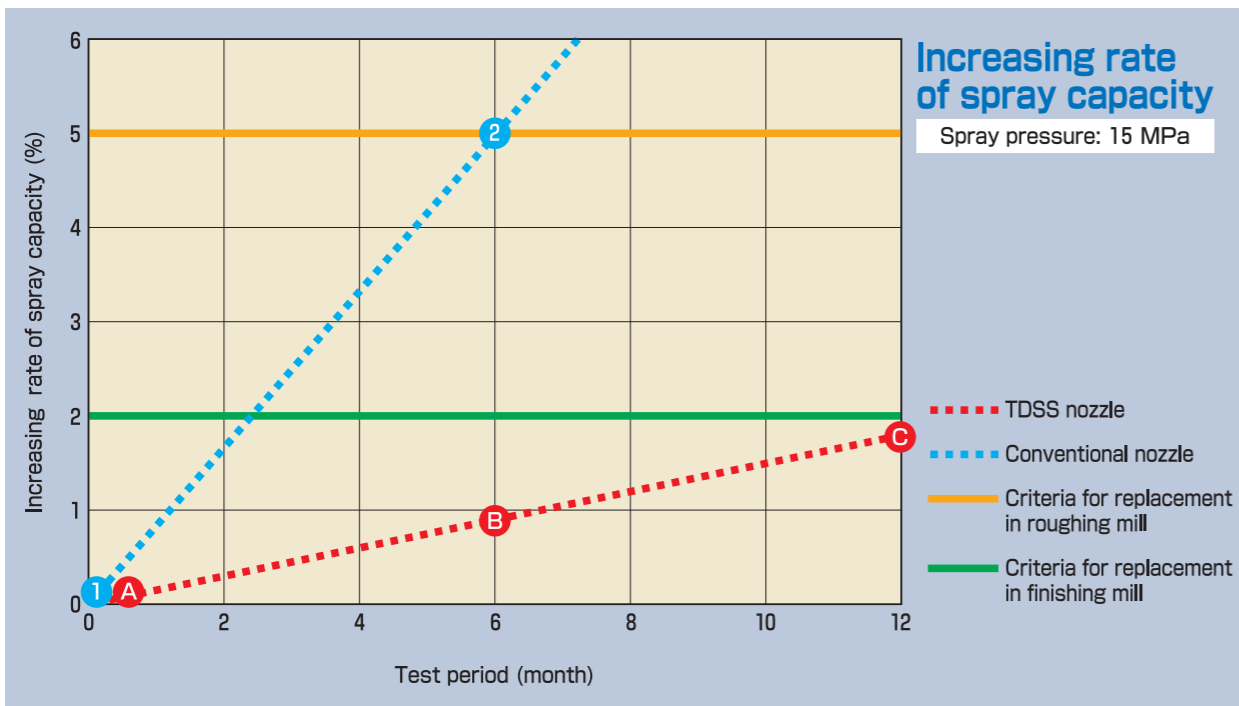
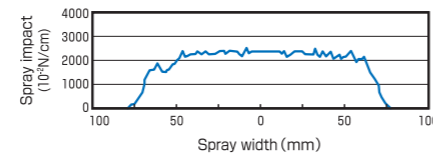
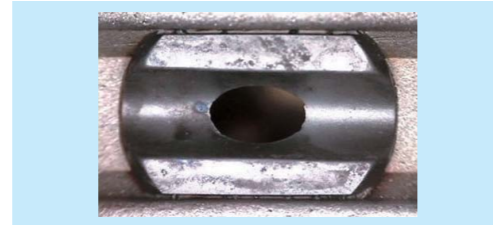
## Wear resistance

As a result of various endurance tests on actual production lines over two years, it was proved that TDSS series nozzles last over two times longer than conventional nozzles.

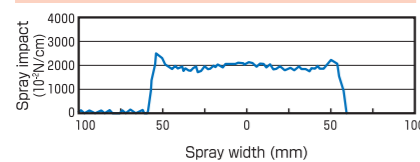
1 Conventional nozzle (New)



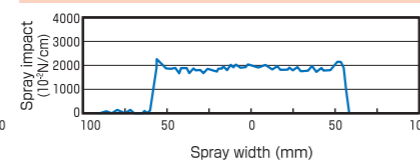
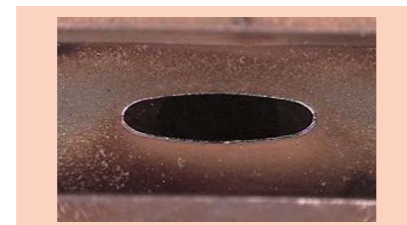
2 Conventional nozzle (6 months later)



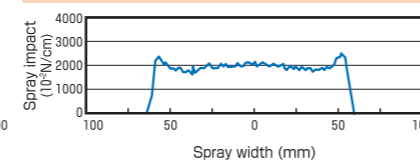
A TDSS (New)



B TDSS (6 months later)



C TDSS (12 months later)

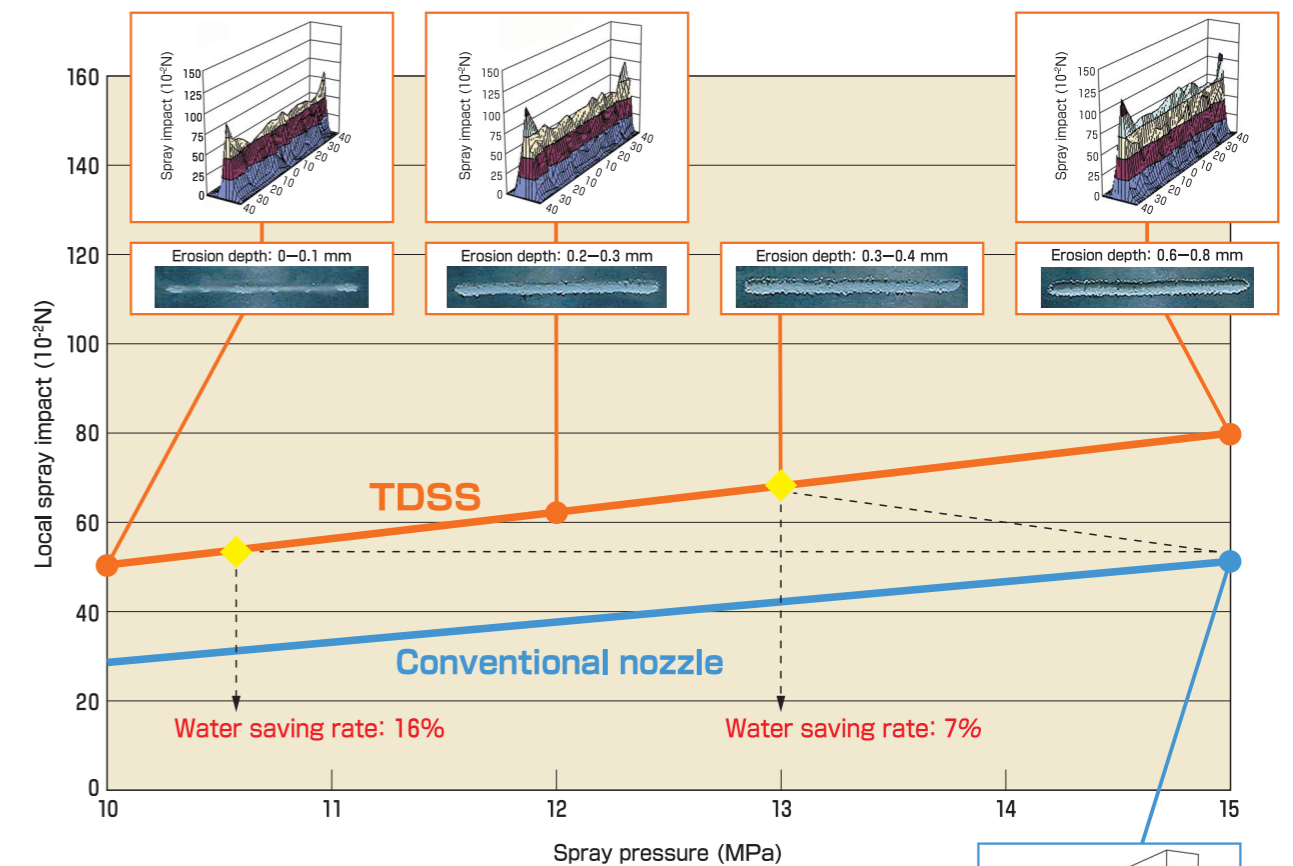


## Water savings

When making flat spray patterns with conventional nozzles, it is necessary to collide water streams inside nozzles. The edge at the orifice, causes water-flow collision, reducing the speed and impact of the water. TDSS, with no edge and thus no loss of speed and spray impact, is designed to produce a thin, razor-like sharp spray.

Compared to conventional models, TDSS provides **the same descaling performance with 10–20% less water.**

### Relations between spray pressure, local spray impact and erosion depth (measuring distance: 200 mm)



● TDSS achieved water savings by **16%** when changed from a nozzle with same local spray impact.

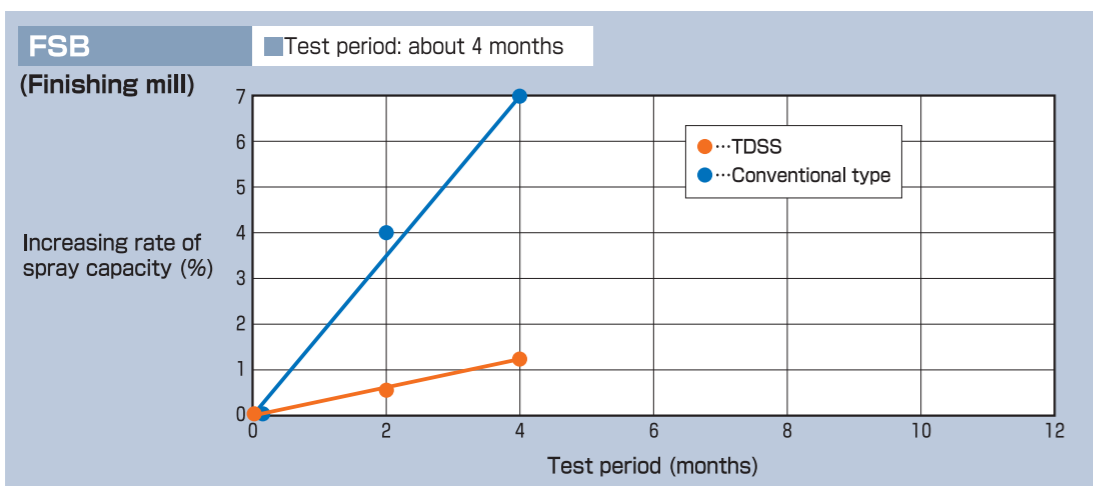
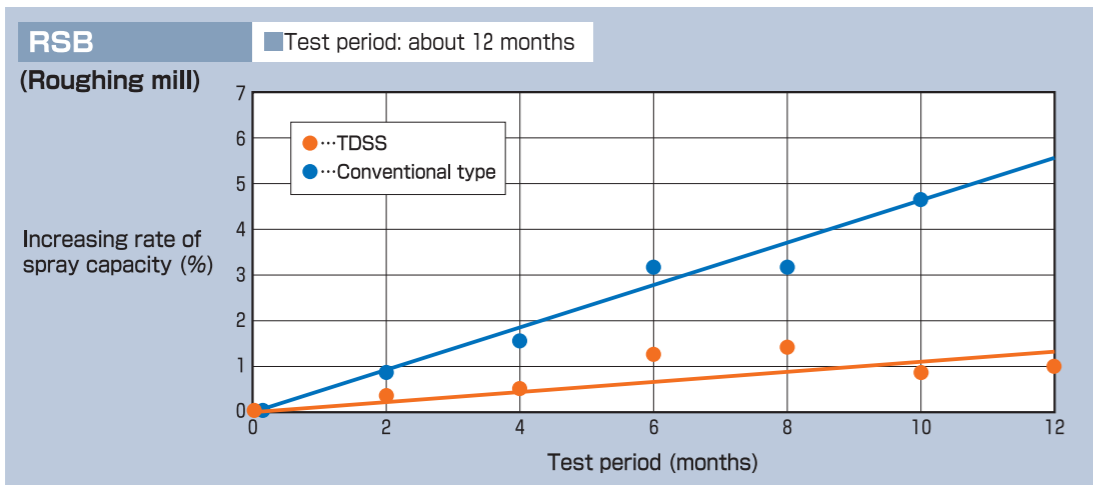
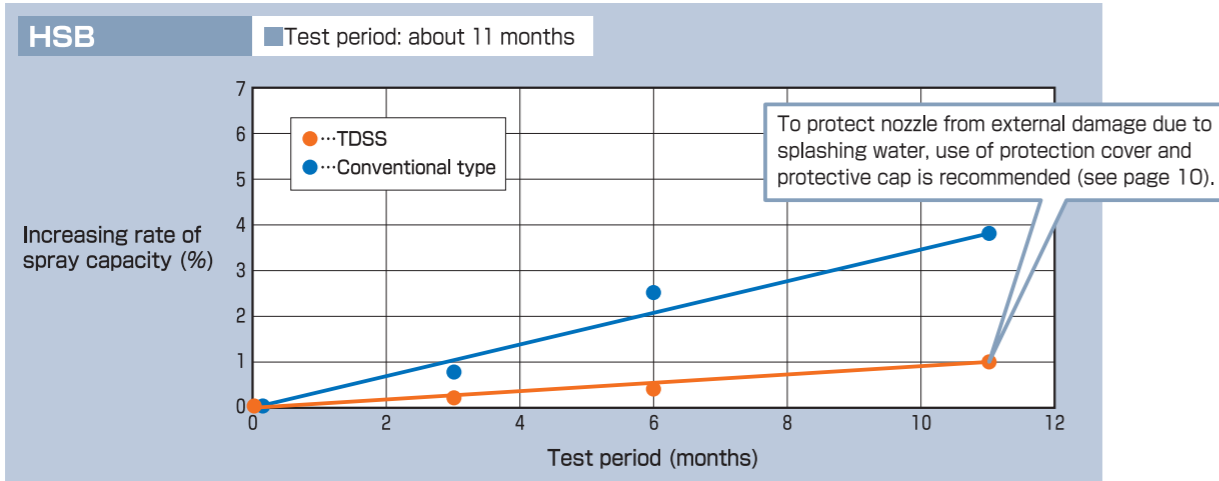
● TDSS achieved water savings by **7%** when changed from a nozzle with same erosion depth.

# Features of TDSS

## Longer lifespan

The below graphs are the result of field testing at actual mills. TDSS, having excellent wear-resistance, had more than two times longer lifespan than conventional nozzles in every steel-making process.

### Results of field test

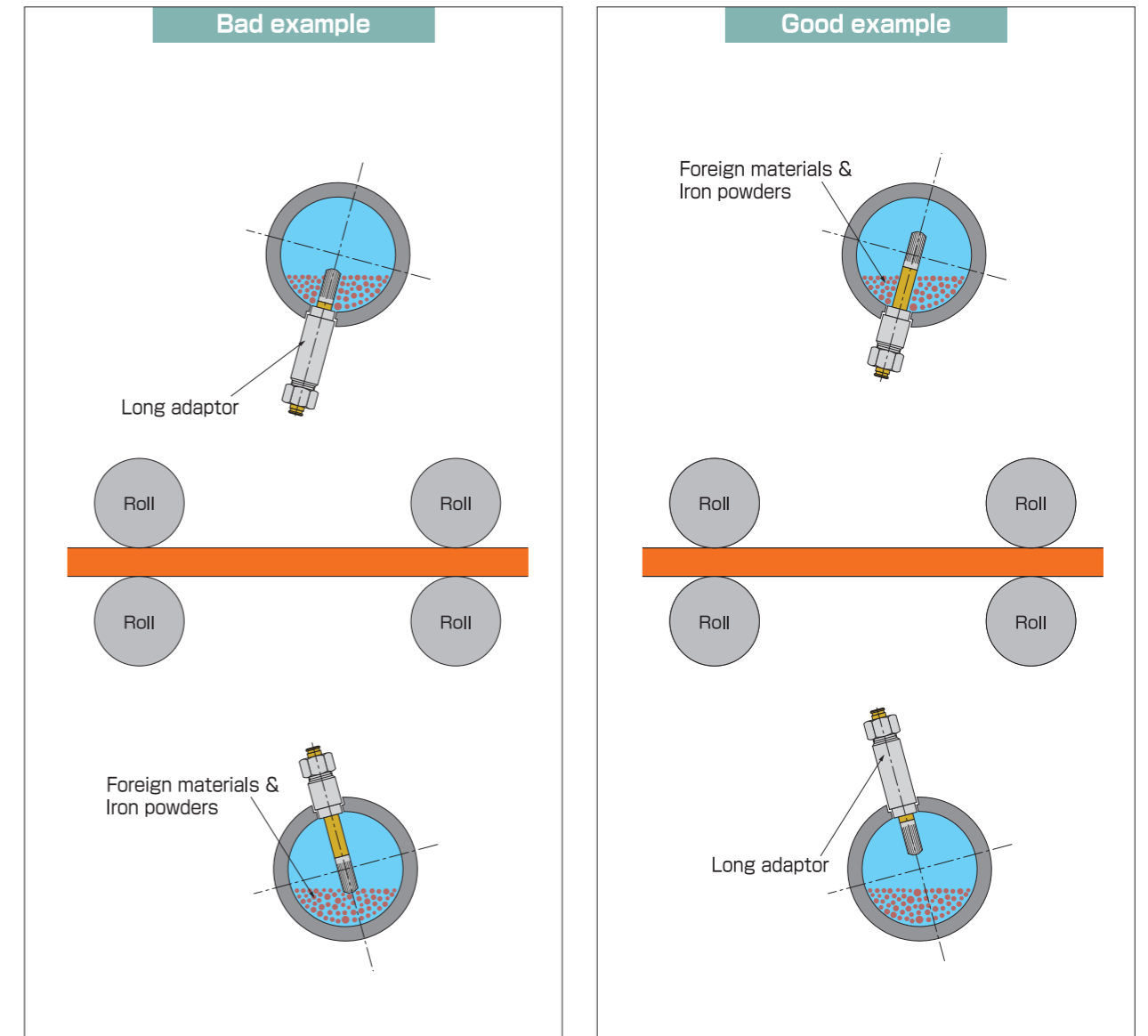


# Technical Information

## Installation position of strainer

### Nozzle strainer position of upper and lower headers

Clogging can be prevented by setting a nozzle strainer away from foreign materials and iron powders settled at the bottom of a pipe.

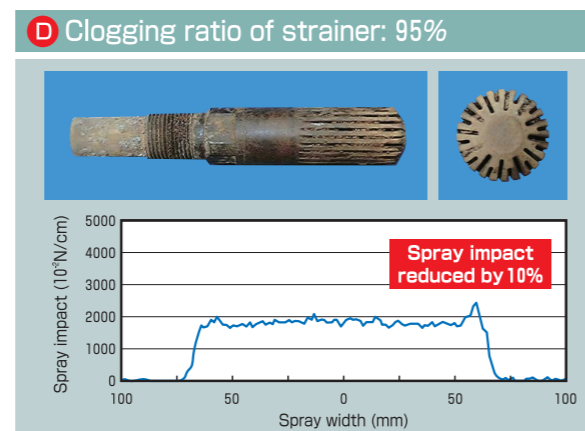
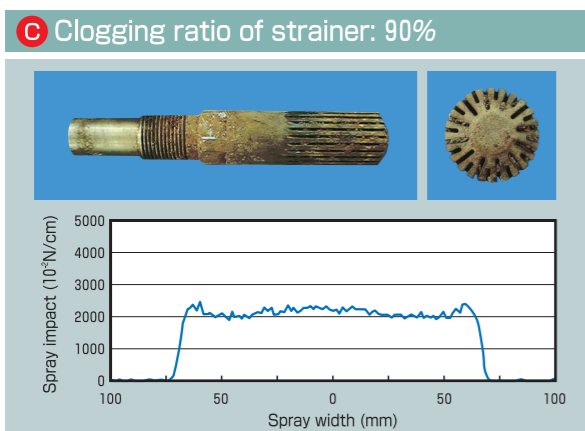
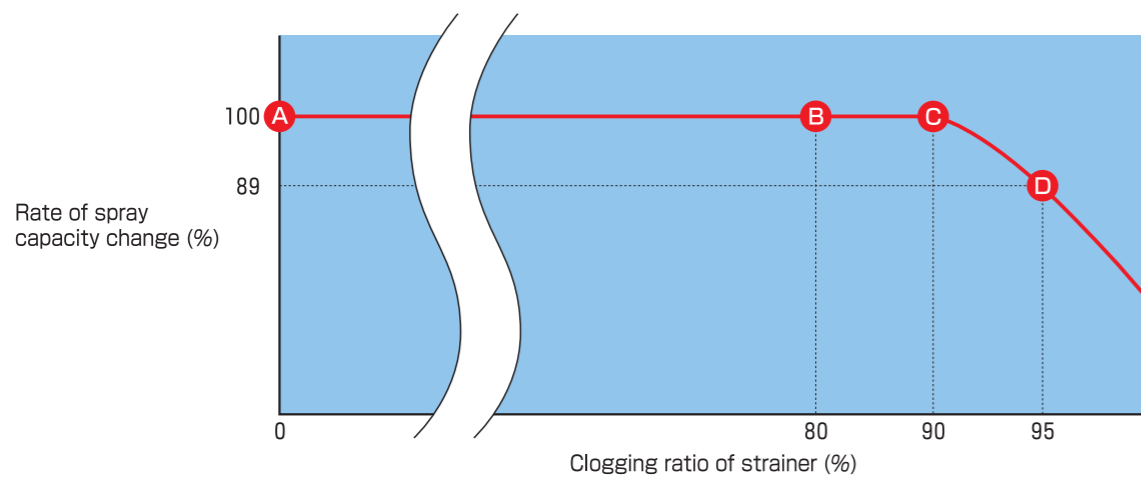
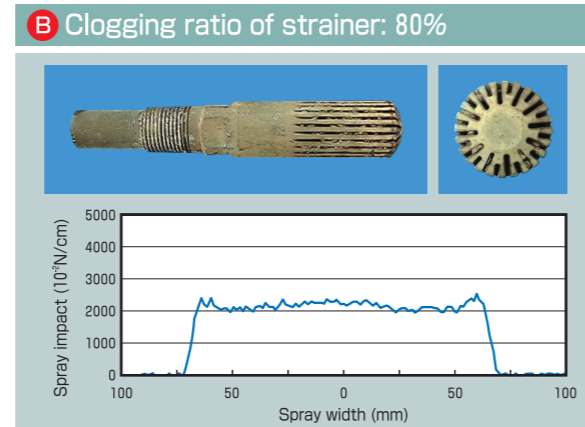
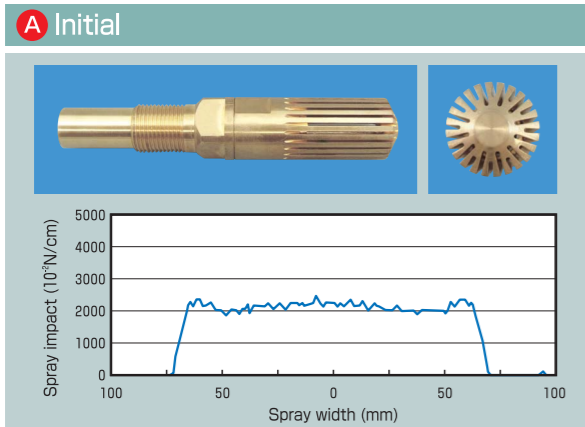


## ● Clogged strainer and nozzle performance

### Model No. TDSS32111-B

Even if clogging ratio of strainer is 90%, clogging has little influence on the spray performance because of larger opening spaces compared to conventional nozzles.

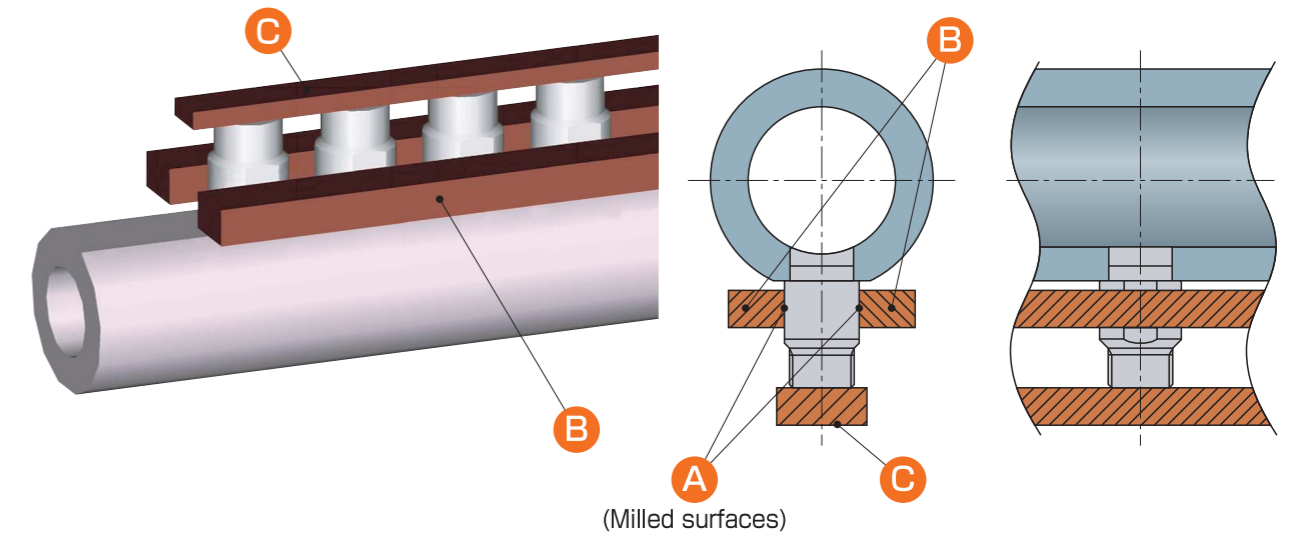
- Water pressure: 15 MPa
- Spray distance: 200 mm
- Spray capacity: 111 ℓ/min
- Effective spray angle: 32°



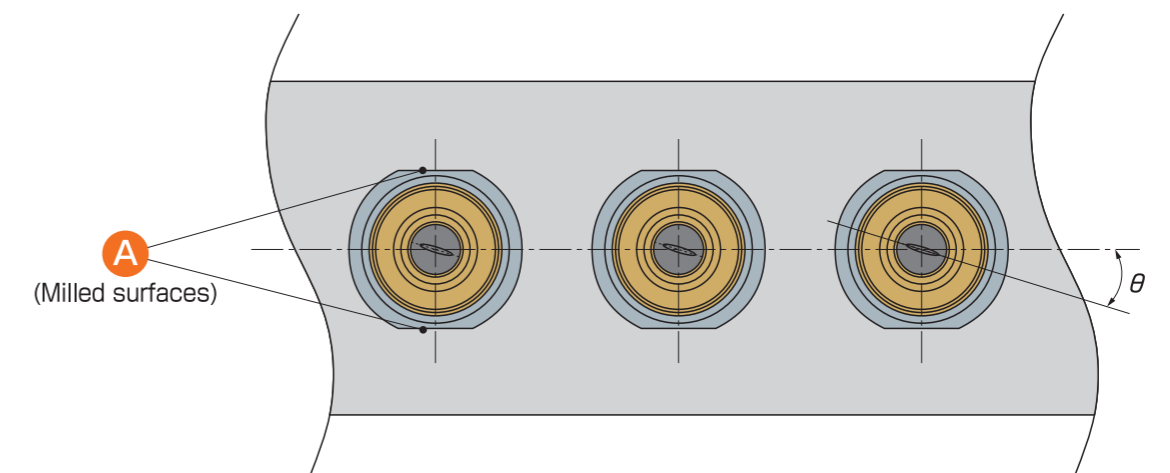
## ● Positioning of welding adaptor

Put plate gauges **B** on both milled surfaces **A** of each welding adaptor along the header to have precise alignment of welding adaptors. Put a plate gauge **C** on the upper surface of welding adaptors to have the same height of each nozzle from the header.

### 1 Positioning of nozzle with offset angle



### 2 Assembly accuracy of nozzles and adaptors



Assembly accuracy of nozzles and adaptors:  $\theta \pm 0.5^\circ$

If welding adaptors are set as described above, assembly accuracy of nozzles and adaptors should be within  $\theta \pm 0.5^\circ$ .

## How to calculate spray impact

- Approximation formula:  $F = \rho \cdot Q \cdot V$
- Sample calculation: Spray impact of TDSS 32111 at water pressure of 15 MPa

$$Q = 111 \text{ l/min} = 111/1000/60 \approx 0.00185 \text{ m}^3/\text{s}$$

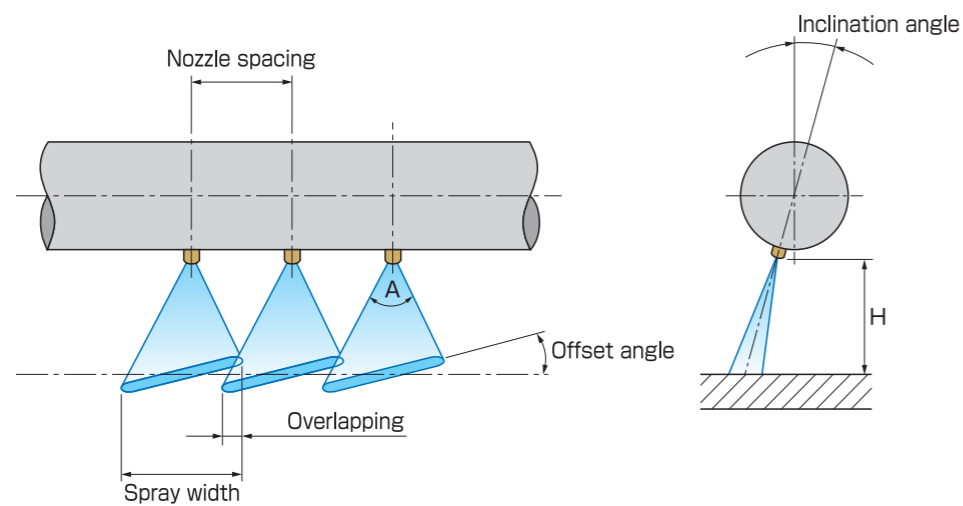
$$V = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 102 \times 15} \approx 173 \text{ m/s}$$

$$F = 1000 \times 0.00185 \times 173 \approx 320 \text{ N}$$

- F = Total spray impact [N]
- $\rho$  = Density [1000 kg/m<sup>3</sup>]
- g = Gravity acceleration [9.8 m/s<sup>2</sup>]
- Q = Spray capacity [m<sup>3</sup>/s]
- V = Velocity [m/s]
- h = Head of water [m] (1 MPa=102 m)
- A = Spray impact area

\*Average spray impact per unit area = F/A

## Recommended nozzle spacing



**Recommended nozzle spacing  
when offset angle is 15° and inclination angle is 15°**


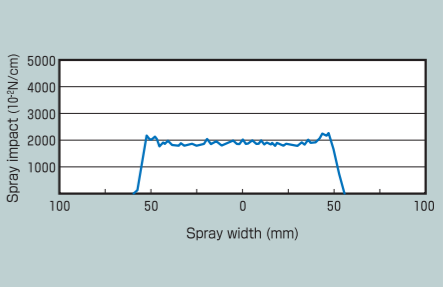
Vertical spray height H (mm)	Spray angle A (°)	40°	35°	32°	28°	25°
100		65	60	55	45	35
200		140	120	110	90	80
300		210	185	170	140	125
400		275	240	225	185	170

(Unit: mm)


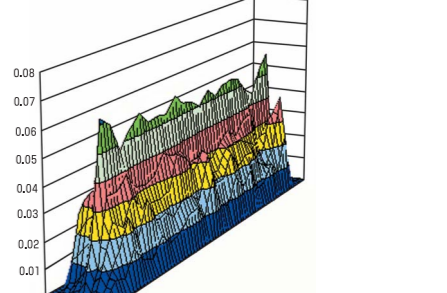
## IKEUCHI's high-precision measurement

The following high-precision measurements support our high-performance design nozzles.


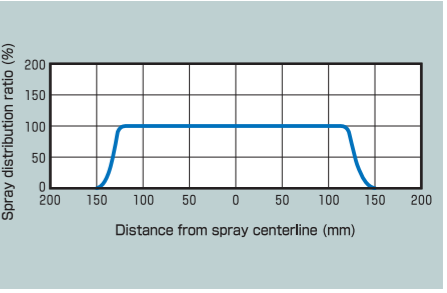
2D  
Spray  
Impact

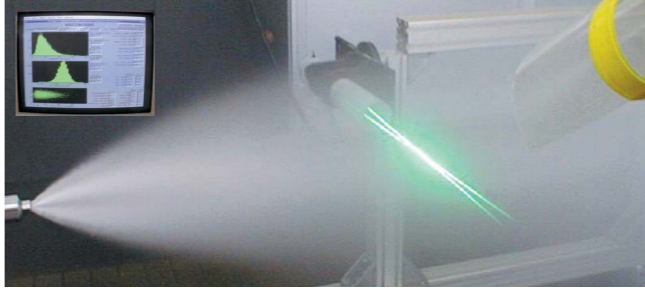
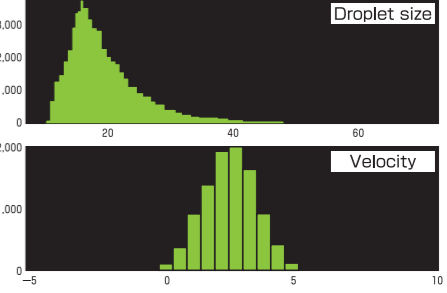
3D  
Spray  
Impact

Spray  
Distribution

Spray  
Droplet Size  
&  
Flow Velocity

\*Not available for measurement of TDSS series nozzles

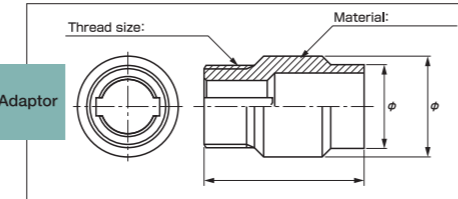
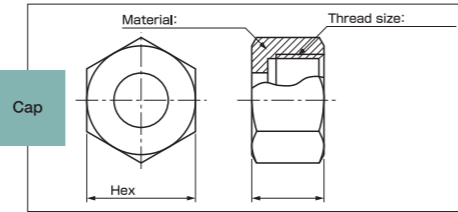
\*Not available for measurement of TDSS series nozzles

# Technical Information

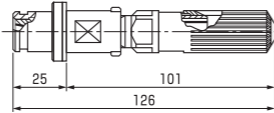
## Specification check sheet

★Please make a photocopy of the form below, fill it in and email us for inquiry.

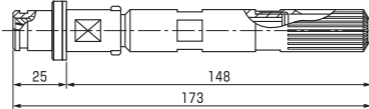
No.	Check points	Contents
1	Customer	
2	Format	<input type="checkbox"/> Strip <input type="checkbox"/> Slab <input type="checkbox"/> Bloom <input type="checkbox"/> Billet <input type="checkbox"/> Round billet
3	Location of descaling installation	<input type="checkbox"/> Behind the furnace <input type="checkbox"/> HSB <input type="checkbox"/> RSB <input type="checkbox"/> FSB
4	Machine maker	
5	Nozzle maker in use	
6	Nozzle model number and specifications in use	[Top] [Bottom]
7	Customer's request or troubles	①
		②
		③
8	Whole length of nozzle [mm]	[Top] [Bottom]
9	Whole length of filter [mm]	
10	With or without check valve	
11	Water pressure in use [MPa]	
12	Spray angle of existing nozzle [°]	
13	Spray capacity of existing nozzle [ℓ/min]	
14	Vertical distance between spray nozzle and pass-line in use [mm]	
15	Spray distance in use [mm]	
16	Vertical distance from header to pass-line in use [mm]	
17	Inclination angle of existing nozzle header [°]	
18	Offset angle of nozzle in use [°]	
19	Spray width [mm]	
20	Spray width in rolling direction [mm]	
21	Overlapping [mm]	
22	Nozzle spacing [mm]	
23	Number of nozzles per a header [pcs]	
24	Number of headers [pcs]	
25	Total number of nozzles [pcs]	
26	Width of plate [mm]	
27	Thickness of plate [mm]	
28	Size of header [inch]	



TDSS type B (Standard type)



TDSS type E (Long type)



TDSS type LCV (with check valve)

